



University of Bahrain
College of Information Technology
Department of Computer Engineering

TEST 1

ITCE 260: Circuit Analysis

Dr. Riyadh Al-Hakim

23 April 2013	Name:	Dept: CE
Time: 60 minutes	ID #:	Section: 1

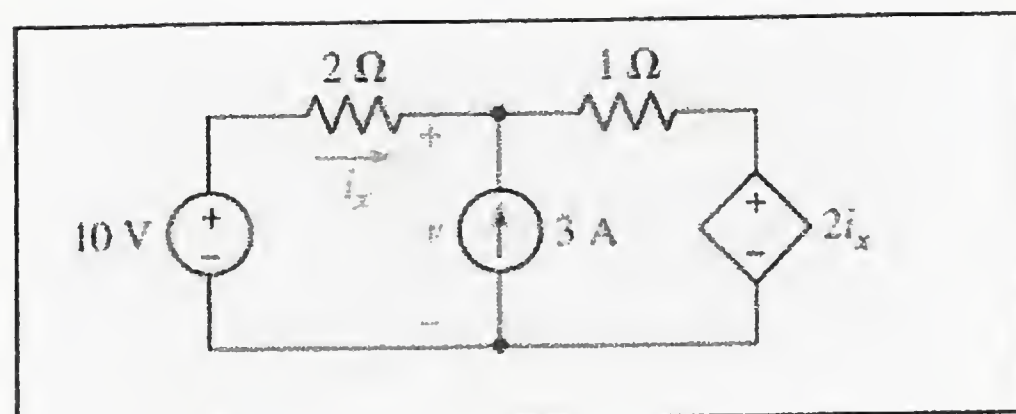
Show your WORK

<u>Q</u>	Max Points	Distribution	Points Scored
1	28		
2	30		
3	30	Soln	
4	12		
Grade out of 100			

Show your WORK

Q1. Use superposition to find:

- The current through $2\ \Omega$ resistor (i_x)
- The voltage v across the current source

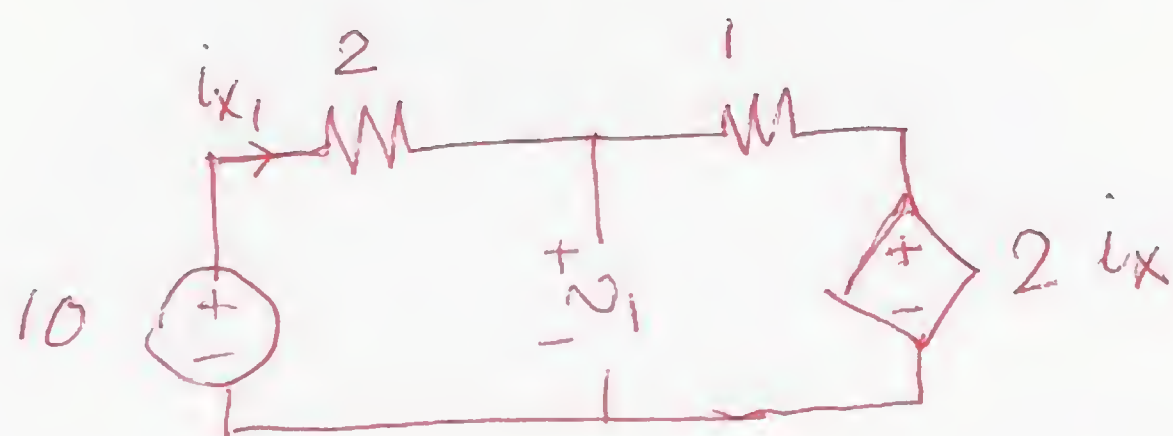


$$i_{x1} = \frac{10 - 2i_{x1}}{2 + 1}$$

$$3i_{x1} = 10 - 2i_{x1}$$

$$i_{x1} = \frac{10}{5} = 2\text{ A}$$

$$\therefore v_1 = 10 - (2\text{ A})(2\ \Omega) = 6\text{ V}$$

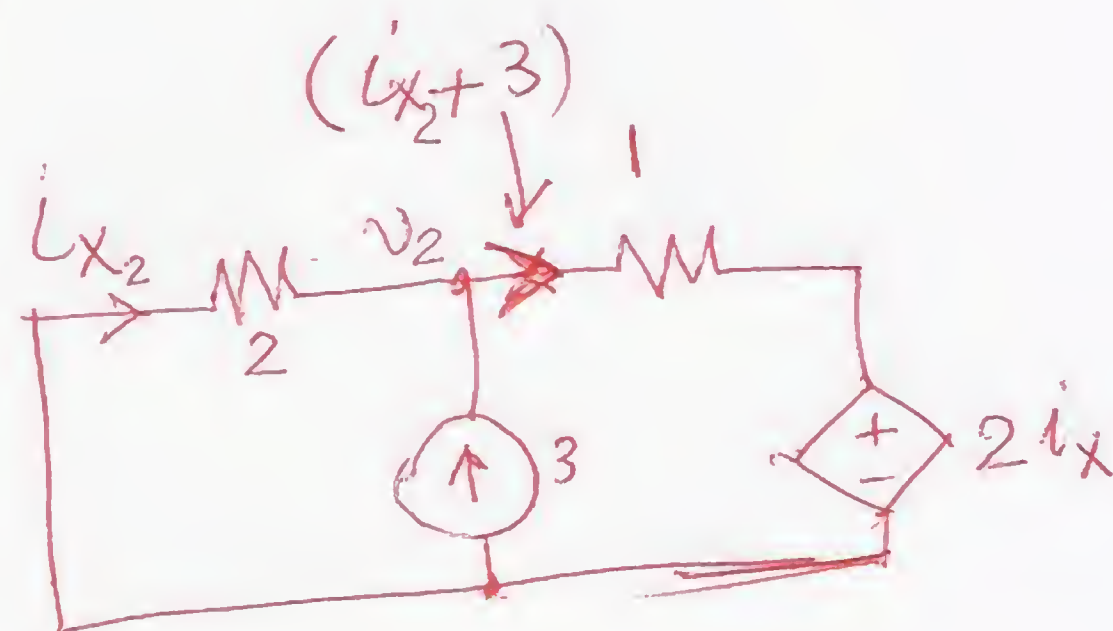


outer mesh

$$2i_{x2} + 1(i_{x2} + 3) + 2i_x = 0$$

$$5i_{x2} = -3$$

$$i_{x2} = -\frac{3}{5}$$



$$\therefore i_x = i_{x1} + i_{x2} = 2 - \frac{3}{5} = \frac{7}{5} = 1.4\text{ A}$$

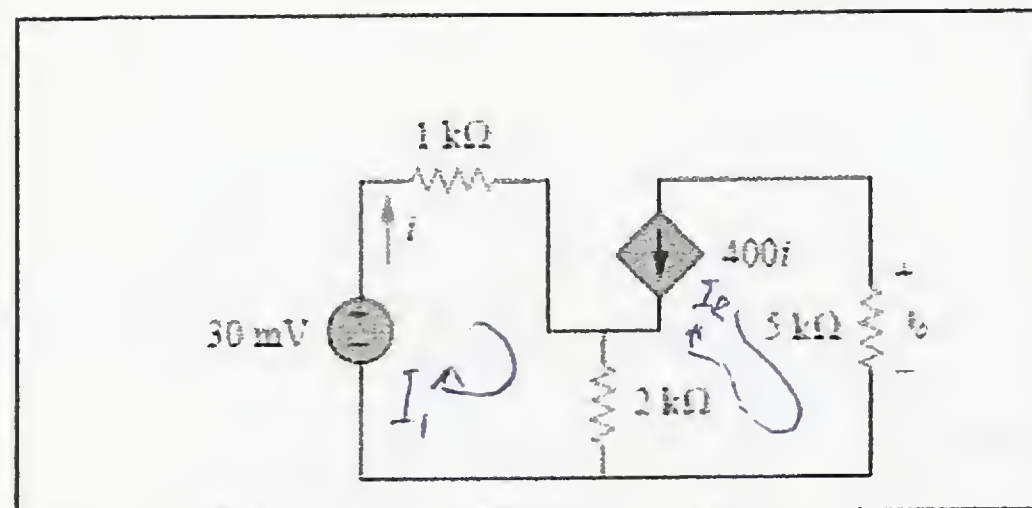
$$v_2 = (-i_{x2})(2\ \Omega) = -(-\frac{3}{5})(2) = +\frac{6}{5}\text{ V}$$

$$\therefore v = v_1 + v_2 = (6 + \frac{6}{5}) = 7.2\text{ V}$$

30

Q2. In the following cct, determine:

- v_o
- Input resistance seen by the 30 mV source



Using mesh analysis:

$$\#1 \quad -30 \text{ mV} + I_1(1\text{k} + 2\text{k}) - 2\text{k}I_2 = 0 \rightarrow (1)$$

$$I_1 = i \rightarrow (2)$$

$$\#2 \quad I_2(5\text{k} + 2\text{k}) - 2\text{k}I_1 = 0 \rightarrow (3)$$

$$I_2 = -400i \rightarrow (4)$$

by subst. (2) and (4) in (1) we get:

$$-30 \text{ mV} + 3\text{k}i - (2\text{k} \times -400i) = 0$$

$$-30 \text{ mV} + 3\text{k}i + 800\text{k}i = 0$$

$$803\text{k}i = 30 \text{ m}$$

$$i = 3.74 \times 10^{-8} \text{ A}$$

$$\therefore V_o = 5\text{k}I_2$$

$$V_o = 5\text{k} \times (-400 \times 3.74 \times 10^{-8})$$

$$V_o = -0.0748 \text{ V}$$

R seen by 30 mV source:

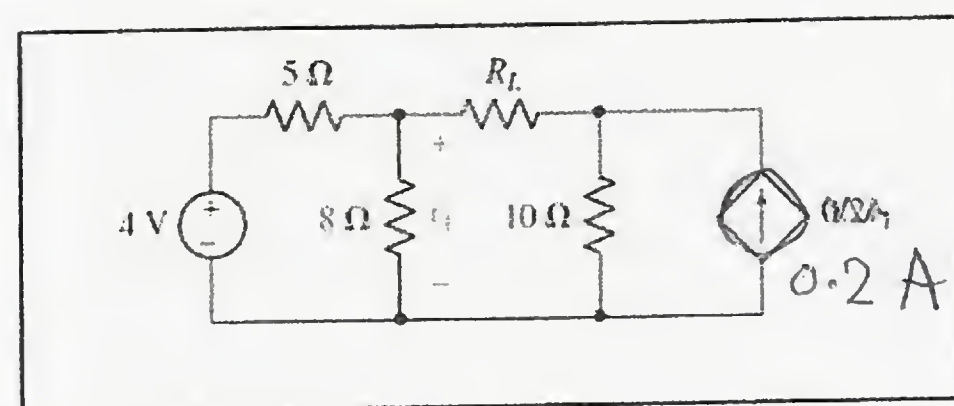
$$R = \frac{V}{I}$$

$$R_{30 \text{ mV}} = \frac{30 \text{ mV}}{I_1}$$

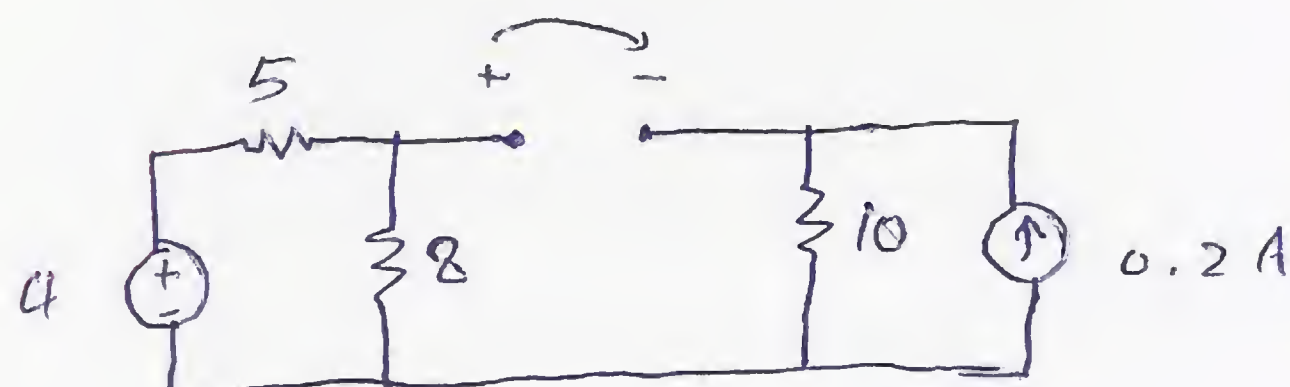
$$R_{30 \text{ mV}} = \frac{30 \text{ mV}}{3.74 \times 10^{-8}} = 802.139 \text{ k}\Omega$$

Q3

- Find R_L which absorbs maximum power
- Determine this maximum power



$$R_{eq} = 10 + 8 \parallel 5$$



$$Max P = \frac{V}{4R}$$

$$5 \parallel 8 \Rightarrow R_{eq} = \frac{40}{13}$$

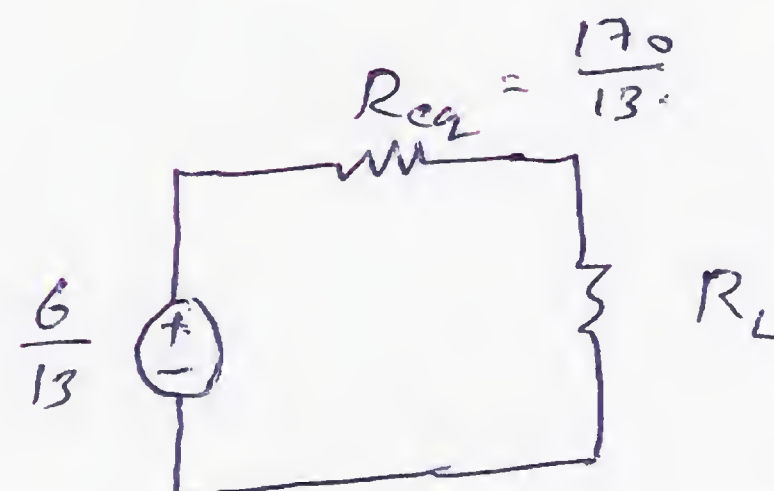
$$R_{eq} = 10 + \frac{40}{13} = \boxed{\frac{170}{13}}$$

$$V_{on 10\Omega} = IR = 10 \times 0.2 = 2V$$

$$V_{on 8\Omega} = \text{voltage divider} = 4 \left(\frac{8}{5+8} \right) = \frac{32}{13}$$

$$V_{th} = V_8 - V_{10} = \frac{32}{13} - 2 = \boxed{\frac{6}{13}}$$

$$\text{Max power when } R_L = R_{eq} = \frac{170}{13}$$



$$P = \frac{V^2}{4R_L} = \frac{\left(\frac{6}{13}\right)^2}{4 \left(\frac{170}{13}\right)} = \frac{36}{1444}$$

$$= 4.1 \times 10^{-3} W$$

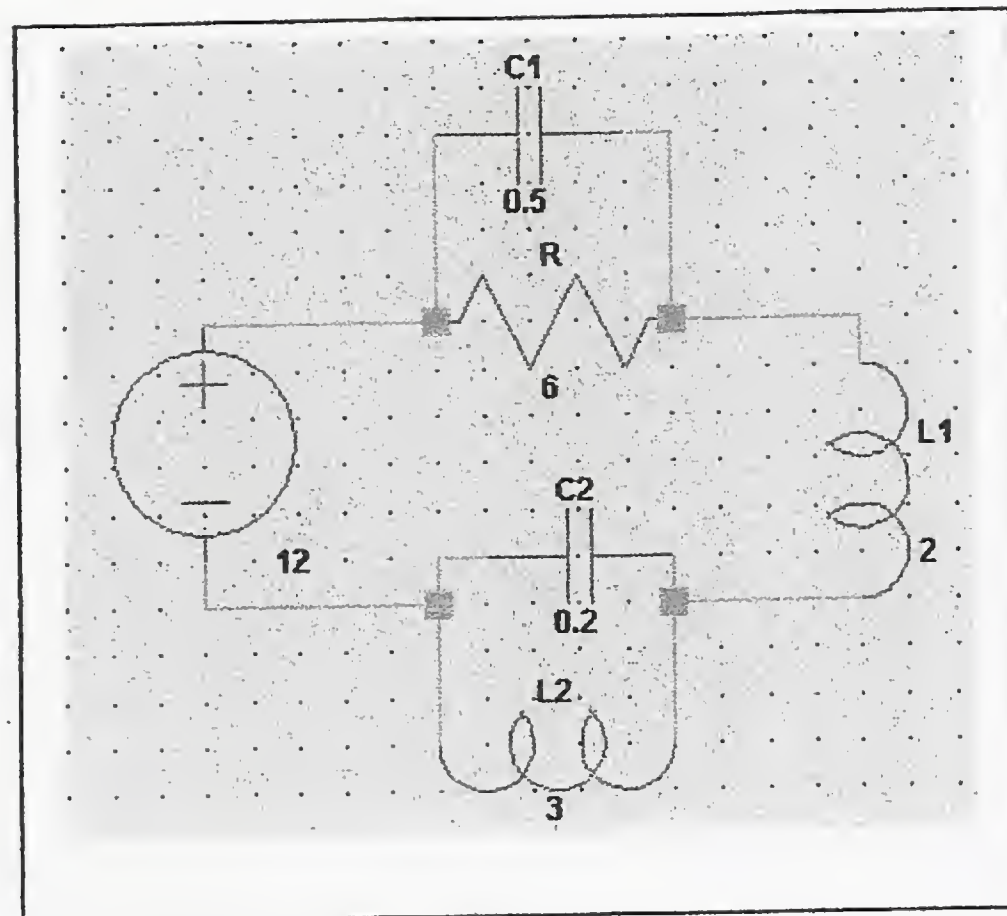


12

Q4. Find energy stored in each L and C of the following cct:

$$\mathcal{E} = \frac{1}{2} C V^2$$

$$\mathcal{E} = \frac{1}{2} L i^2$$



$$i = \frac{V}{R}$$

$$i = \frac{12}{6} = 2 \text{ A}$$

$$\mathcal{E}_{L1} = \frac{1}{2} L i^2$$

$$= \frac{1}{2} (2) (2)^2 = 4 \text{ J}$$

$$\mathcal{E}_{L2} = \frac{1}{2} L i^2 = \frac{1}{2} (3) (2)^2 = 3 \times 2 = 6 \text{ J}$$

Voltage across capacitor 1 = V_R

$$V_R = IR = 2 \times 6 = 12$$

$$\mathcal{E}_{C1} = \frac{1}{2} C V^2 = \frac{1}{2} \left(\frac{1}{2} \right) (12^2) = 36 \text{ J}$$

$\mathcal{E}_{C2} = 0$ because there is no voltage

